# LONDON FOGGERS

**Used everywhere in the world**

***since 1968***

# MODEL 18-20

## High Output ULV Aerosol Generator

## Machine Operators Manual

HOOT
NOZZLE

PISTOL GRIP
CAB CONTROL

*Used everywhere in the world*

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# LONDON FOGGERS

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**LONDON FOG, INC. SUBJECT TO THE PROVISIONS BELOW WARRANT EACH NEW PRODUCT MANUFACTURED BY THE COMPANY TO BE FREE FROM DEFECTS IN MATERIAL AND/OR WORKMANSHIP IN NORMAL SERVICE FOR THE PERIOD ON ONE (1) YEAR COMMENCING WITH DELIVERY OF THE MACHINE TO THE ORIGINAL USER.**

The obligation under this warranty is expressly limited to the replacement or repair, at the Company's option, at the plant of LONDON FOG, INC., Long Lake Minnesota or at a service facility designated by the company, of such part or parts as
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WRITTEN WARRANTY AND NO ONE IS AUTHORIZED TO MODIFY THIS WRITTEN WARRANTY.**

# CUSTOMER SERVICE - A TRADITION

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## I. SPECIFICATIONS

| | | |
|---|---|---|
| TYPE: | Vehicle or trailer mountable - non-thermal, U.L.V. (Ultra Low Volume) Cold fog aerosol generator. | |
| ENGINE: | Twin cylinder Kohler with over head valves, 4-cycle, gasoline, 18 h.p., 12 V. Fuel Consumption - regular or no lead automotive 1 gal/hr. Electric start with alternator, pressure lubrication and oil pressure sensing system. | |
| AIR PUMP: | Positive displacement, rotary, cast iron. 2500 RPM, 6 p.s.i. | |
| FORMULATION PUMP: | Positive displacement piston pump with adjustable output from: 0 to 20 oz./min. (0 to 491 ml/min.) | |
| NOZZLE SYSTEM: | High output, noise dampened with 360 degree horizontal and vertical adjustment. | |
| TANKS: | All tanks corrosion-resistant, high density polyethylene.<br>Formulation: 15 U.S. Gallons (56.7 liters)<br>Flushing: 1.5 U.S. Quarts (1.42 liters)<br>Gasoline: 6.0 U.S. Gallons (22.7 liters) with cleanable filter. | |
| PARTICLE SIZE: | 80% of droplets less than 20 micron diameter depending on flow rate and viscosity. | |
| DIMENSIONS: | Weight Empty: 460 pounds (209 kilograms)<br>Length: 46 inches (115 cm)<br>Width: 33 inches (83 cm)<br>Height: 27 inches (92) | |
| ENGINE: | Power Rating at 3600 RPM: | 18 hp (13.4 kw) |
| | Displacement: | 38.1 cu. in. (624 cc) |
| | Bore: | 3.03 in. (77 mm) |
| | Stroke: | 2.64 in. (67 mm) |
| | Compression Ratio: | 8.5:1 |
| | Oil Capacity (w/filter)*: | 2.1 Pt. (2 L) |
| | Spark Plug Type: | RV12YC Champion or Equiv. |
| | Spark Plug Gap: | 0.030 in. (.76 mm) |
| | Spark Plug Torque: | 18-22 ft.lb. (24.4-29.8 Nm) |
| BLOWER: | Frame Size | 45 |
| | Maximum RPM: | 3000 |
| | Maximum Pressure | 10 PSI (.014 Kgm2) |
| | Recommended Gear Oil: | SAE 40 non-detergent |
| | Gearbox Capacity: | 12.7 fl. oz. (0.37 L.) |

* For best results, fill the "F" mark on dipstick as opposed to adding a given quantity of oil. Always check level on dipstick before adding more oil. For engines equipped with oil filter - an additional 1/2 U.S. pint (.24 L) of oil is required when oil filter is replaced.

## II. SAFETY PRECAUTIONS

### WARNING

**READ AND UNDERSTAND THESE SAFETY PRECAUTIONS BEFORE OPERATING MACHINE.**

1. **ENGINE AND FUEL:** This machine uses gasoline as the fuel for the internal combustion engine and all precautions commonly applying to this volatile fuel should be observed. Exercise extreme caution to avoid spilling of gasoline. If spillage occurs, wipe if off and allow evaporation time before starting the engine. DO NOT attempt to put fuel in the tank while the machine is still running. Avoid smoking or open flame in area when handling gasoline. Never run the unit indoors unless exhaust is vented to outside. These fumes contain carbon monoxide which is colorless and odorless and can be fatal.

   CAUTION:

   DO NOT OPERATE ENGINE WITHOUT MUFFLER

   DO NOT TOUCH HOT MUFFLER, CYLINDERS OR FINS AS CONTACT MAY CAUSE BURNS.

   Except for adjustment, DO NOT OPERATE THE ENGINE IF AIR CLEANER OR COVER DIRECTLY OVER THE CARBURETOR AIR INTAKE IS REMOVED.

   DO NOT RUN THE UNIT IF THE BELT GUARD IS REMOVED.

   DO NOT TAMPER WITH GOVERNOR SPRINGS, GOVERNOR LINKS OR OTHER PARTS WHICH MAY INCREASE OR DECREASE THE GOVERNED ENGINE SPEED.

2. **ENGINE SPEED:** (RPM) should be checked periodically to ensure that it is operating correctly as engine speed effects the rate of air flow through the nozzle system which controls droplet particle size. The correct engine speed should be 1800-3300 RPM.

3. **BLOWER CASING:** Blower casing and associated piping or accessories may become hot enough to cause skin burns on contact.

   A. DO NOT TOUCH WHEN HOT
   B. Do not reach into any opening in the blower while it is operating, or while subject to accidental starting.
   C. Disconnect power before doing any work and avoid bypassing or rendering inoperative any safety or protective devices.
   D. DO NOT operate blower with inlet filter removed.
   E. DO NOT stand in the discharge air blast from the nozzle.
   F. Avoid extended exposure in close proximity to machinery which exceeds safe noise levels.

II. SAFETY PRECAUTIONS (continued)

4. **MACHINE DAMAGE:** Never operate a machine after it has been damaged. A damaged machine can be very hazardous.

5. **WIND:** Spraying during windy conditions is not usually practical because the formulation will drift out of the intended area.

6. **SAFETY EQUIPMENT:** In addition to any safety equipment that may be required by the type of formulation which is being used, the following items should be with each vehicle which carries this machine during fogging operations:

   A. Fire Extinguisher, chemical type rated for fuel fires.
   B. First Aid Kit.
   C. Eye Wash Solution.
   D. Safety Glasses.
   E. Container of Oil Dry Compound.
   F. Gloves rated for high temperature.
   G. Respirator adequate for formulation being used.

7. **CHILDREN:** Many spraying operations are performed in residential areas commonly at dusk. This presents the operator with the problem of children who are attracted to the noise and/or the mist being created. The possible hazard lies in the toxic effect of some formulations, the severity of which depends upon the chemical used, mist density, and the length of time of direct exposure. IT IS THE OPERATORS RESPONSIBILITY TO DISCOURAGE ANYONE FROM PLAYING IN THE MIST OR BEING NEAR THE MOVING VEHICLE.

8. **FORMULATIONS:** Ensure that formulations are applied only in strict compliance with formulation label as well as local, state, and federal regulations.

   A. Always comply with any requirements for protective clothing, goggles, gloves, facial masks, or respirators required on the formulation label.
   B. DO NOT exceed the dosage set forth on the registration label of the insecticide to be used.
   C. Always store formulation in its original labeled container.

IN NO WAY IS IT TO BE CONSTRUED THAT THE CHEMICALS AND/OR DOSAGES ARE THE RECOMMENDATION OF LONDON FOG, INC.

LONDON FOG INC., SHALL IN NO EVENT BE LIABLE FOR CONSEQUENTIAL DAMAGES OR CONTINGENT LIABILITIES ARISING OUT OF THE FAILURE OF ANY AEROSOL GENERATOR OR PART TO OPERATE PROPERLY.

## III. ASSEMBLY / INSTALLATION

1. **SHIPPING CONTAINER:**

Remove the protective shipping container. Look for any hidden shipping damages and if present, report it immediately to the carrier.

NOTE: It is a good idea to retain the original machine shipping carton as well as its inner packing and blocking materials for any future storage and/or shipment which may be required.

2. **REMOTE CONTROL UNIT ASSEMBLY:**

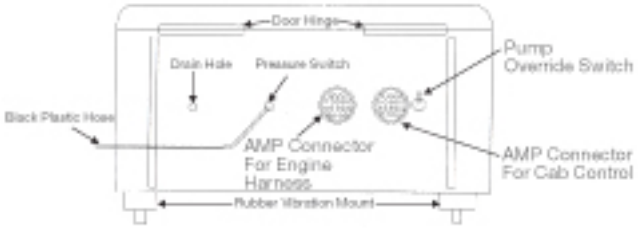
A. Place the Remote Cab Control Unit where it will not be damaged while machine is being prepared.

B. Lift the machine onto the vehicle with the discharge end of the machine toward the rear of the vehicle.

C. Pass the Remote Cab Control Unit through an open window and locate within reach of the person who will be operating the machine. If permanent vehicle installation is desired, the remote control cable can be passed through a small hole in the vehicle cab and then reconnected. Make sure the small hole provides proper protection against wiring damage and is re-sealed to prevent exhaust gases from entering inside of the vehicle.

D. Using the most convenient routing, run the cab control to the outermost electrical socket (blower end) on the flow control pump box. As the machine is shipped, this will be the only unused socket. All the electrical connectors on the machine are polarized to prevent incorrect connections.

Underside of Pump Box View




E. Orient the electrical plug on the cab control so that the electrical pin locations match the mating pin receptacles in the socket and push the plug firmly into the socket.

3. **INSTALLATION:**

A. Securely bolt the machine to the vehicle.

B. Loosen then nozzle swivel joints and orient the nozzle as required by the formulation label. Usual set up is towards the rear and 45 degrees up. Retighten joints.

C. Correct battery type is 24/24m series with marine style wing nut terminals.

4. **BATTERY INSTALLATION:**

A. New (Dry) Battery.

(i) Remove the battery from its box and place it on a stable work surface in a well ventilated area.

(ii) Remove vent caps for battery. Remove or destroy any sealing devise which may have been used to close or restrict the vent openings in the caps.

(iii) Fill each cell of the battery to the top of the separators with approved battery electrolyte of 1.265 specific gravity. Temperature of battery and electrolyte at the time of filling should be above 60 degrees F. (15 degrees C.)

CAUTION:

Never fill battery in machine as spills will damage finish on frame and cause premature corrosion.

(iv) Charge 12 Volt battery at 30-40 amps until the acid temperature is above 80 degrees F. (26 degrees C.) and the hydrometer reading is 1.250 or higher.
Both temperature and hydrometer reading requirements must be met.

(v) After charging the battery, check acid levels in all cells and fill each cell with acid to the proper level.

(vi) Re-install vented caps.

(vii) Re-install the battery onto machine.

(viii) Connect positive (+) cable (leading from the starter solenoid which is located on the engine) to the positive (+) post on the battery and tighten bolt.

(ix) Connect the negative (-) cable to the negative (-) post on the battery and tighten bolt.

NOTE: After battery has been initially serviced, only water should be added to restore the liquid level in each cell. Further addition of acid will cause battery failure.

B. Wet (Sealed) Battery:

(i) When installing battery, connect the negative (-) cable last to prevent sparking and shorting.

(ii) When disconnecting is required, remove negative (-) connection first.

(iii) Reversed polarity can cause damage to the starting and charging systems.

## IV. SERVICE BEFORE START-UP

1. **ENGINE**

   A. Gasoline - Service the engine with gas and oil. For best results, use only regular unleaded gasoline with an octane rating of 87 or higher. In countries using the research method, it should be 90 octane minimum. If leaded gasoline is used, combustion chamber, cylinder head and spark plug may require more frequent service (see SERVICE SCHEDULE, section VIII).

   B. Oil - Use high quality oil of API service class SF. Multi-Viscosity SAE 10W-30 is recommended.

Make sure the machine is sitting level. Add the proper type oil through the oil fill tube to bring the level up to, but not over, the "F" mark.

CAUTION:
DO NOT operate the engine with oil level below the "L" mark or over the "F" mark.

2. **BLOWER**

   A. Before starting machine, be sure the gearbox on the blower is filled to the proper level with oil.

   B. To fill the gearbox, remove the combination breather/knob on the top side of the gear box and also remove the lower 1/4" pipe plug (called the overflow hole) which is on the air filter side of the gear box.

      USE SAE 40 NON-DETERGENT OIL.

      Fill the gearbox up to the lower overflow hole. Replace the plug and the breather.

      DO NOT OVERFILL.

3. **FORMULATION**

   Place formulation in the large black formulation tank. Always use a funnel and strainer to avoid getting dirt or other contaminates in the tank.

   USE ONLY FORMULATION THAT IS LABELED FOR THE INTENDED USE.

4. **FLUSHING FLUID**

   Using a funnel with strainer or filter, place appropriate flushing fluid (for the formulation being used) in the flushing tank.

## V. PRE-START CHECKLIST

| | | SEE SECTION # |
|---|---|---|
| All safety equipment is in place | _____ | I. |
| Remote control panel in place | _____ | IV. |
| Battery is secure in place | _____ | IV. |
| Sufficient gasoline in gas tank | _____ | IV. |
| Oil in engine at proper level | _____ | IV. |
| Oil in air pump at proper level | _____ | IV. |
| All hoses tight and connected | _____ | |
| Sufficient formulation in tank | _____ | IV. |
| Flushing fluid in flush tank | _____ | IV. |
| Flow rate is calibrated | _____ | VII. |
| Nozzle is aimed correctly | _____ | III. |
| Spray switch is in OFF position | _____ | VI. |
| Selection switch is in SPRAY position | _____ | VI. |
| Ignition switch is in OFF position | _____ | VI. |
| Pump override switch is in OFF position | _____ | VII. |

CAUTION

Before proceeding with any spraying operation, the operator should be thoroughly familiar with starting and stopping the machine and with all the operating controls. If you are operating the machine for the first time, exercise the machine through its full operational sequences from a position of full visibility of the machine before operating the machine fully remote. This is also a good idea for experienced operators who may be operating a new machine or who may be reactivating a machine after repairs or a period of inactivity. Refer to the operation section for starting and stopping instructions.

## VI. START-UP / SHUTDOWN

1. Be sure to complete the service before start-up: pre-start check list and all safety precautions, before starting machine.

2. **START**

   Move the engine ignition switch (on the control panel, see figure 2 - section VII) to the "ON" position.

   A. On a cold engine, push both the start and the choke buttons at the same time. As soon as the engine starts to fire, release the choke button. Release the start button as soon as the engine can run on it's own.

      On cold engines, it may be necessary to intermittently push the choke button until the engine is running smoothly.

      NOTE: The best starter life is provided by using short cranking cycles of several seconds; prolonged cranking can damage the starter motor if cranked more than 15 seconds per minute.

   B. On a warm engine, push the starter button until the engine starts.

      If a very hot engine fails to start, some choking may be required.

      CAUTION:

      If the engine develops enough speed to disengage the starter but does not keep running (false start) the engine rotation must be allowed to come to a complete stop before pushing the starter button again. Failure to do so will damage the starter drive.

3. **SHUT OFF**

   A. Control Panel

      To turn off the engine move the stop switch to the "OFF" position.

## VII. OPERATION

Read this complete OPERATION section and the section on SAFETY PRECAUTIONS before starting the machine.

For first time operation the sections on INSTALLATION, SERVICE BEFORE START UP, and PRESTART CHECKLIST must be performed before proceeding with operation.

When operating this machine for the first time, move to an uncongested and well ventilated work area in an open area away from flammable materials.

WARNING

READ THE SECTION ON SAFETY PRECAUTIONS BEFORE PREPARING TO DISPENSE FORMULATION.

READ AND THOROUGHLY UNDERSTAND ALL INFORMATION, CAUTIONS AND WARNINGS ON THE FORMULATION LABEL WHICH MAY AFFECT PERSONAL SAFETY. KNOW ANY DANGERS OF THE SOLUTION USED AND KNOW WHAT TO DO IN CASE OF AN ACCIDENT INVOLVING THE SOLUTION.

ALWAYS USE THE APPROPRIATE SAFETY EQUIPMENT AND DRESS ACCORDING TO THE CHEMICAL FORMULATION WHICH IS BEING USED.

DO NOT USE ANY SUBSTANCES FROM UNMARKED CONTAINERS OR FROM CONTAINERS WITH OBVIOUSLY ALTERED LABELS.

READ AND FOLLOW THE INSTRUCTIONS ON THE CHEMICAL SOLUTION LABEL FOR ULV SPRAYING OF THE SOLUTION.

DO NOT SPRAY NEAR AN OPEN FLAME OR HOT MATERIALS.

DO NOT LEAVE THE MACHINE UNATTENDED.

### 1. SPRAYING

A. With the engine running (it will only be at idle), move the selector switch on the control panel to the desired SPRAY or FLUSH position.

B. Turn the spray switch on the control panel to the ON position (engine ignition switch must be on for spray pump to operate). The engine will automatically throttle up from the idle position.

CAUTION:

Before dispensing insecticide, be certain that no one is present in the area of the nozzle or aerosol dispersion area.

ON
OFF
POWER
FLUSH
FORMULATION
18-20
LONDON FOG
INCORPORATED
SPRAY
ON
OFF
ENGINE
START CHOKE
ON
OFF

C. To Stop spraying, turn the spray switch to the OFF position.

D. When the spraying operation is complete, the unit must be flushed in accordance with FLUSHING SYSTEM section of this manual.

**2. SETTING THE FLOW RATE**

NOTE: Since this machine may be used with various materials, the machines are shipped with the flow rate set at approximately 4.0 fl. oz/min.

A. Loosen the two screws holding the flow control pump box shut and open the pump box cover.

B. Loosen the pump pointer locking plate by loosening the two knurled rings, one each side of the locking plate.

C. Move the blue handle/pointer until the desired flow rate is obtained.

NOTE: All flow rates must be determined by calibration - see OPERATION, section VII-3.

D. Lock the pointer handle at the desired flow rate setting by tightening the two knurled rings. DO NOT OVER TIGHTEN. Do not use any additional wrenches. Hand tighten only.

E. Close the pump box Close the pump box fasten latches.

**3. CALIBRATION**

NOTE: All calibrations must be made with the engine running and the fluid flowing through the nozzle.

A. Loosen the two screws holding the flow control pump box shut and open the pump box cover.

B. Run the engine and turn the spray switch to the "ON" position until the fluid lines are filled from the formulation tank to the spray nozzle and no air is trapped in the lines.

C. Remove the fluid line from the formulation tank and insert it into a 1000 ml. graduated cylinder filled with your formula.

D. With the engine running, turn the spray switch "ON" for a measured amount of time using a stop watch. Record the flow rate and pump setting for future reference.

E. Loosen the pump pointer locking plate by loosing the two knurled nuts and adjust pointer as needed. Tighten the two knurled nuts.

F. Refill the graduated cylinder and repeat steps D and E until the desired flow rate is obtained.

G. Replace the fluid line to the formulation tank.

The following are rough estimates of flow rates using very light mineral oil. Always calibrate to establish correct flow rates for the chemical or insecticide to be used.

| Flow Rate (ml/minute) | Flow Rate (oz./minute) | Scale Setting |
|---|---|---|
| 95 | 3 | .50 |
| 150 | 5 | 1.00 |
| 250 | 8.40 | 1.50 |
| 320 | 10 | 2.00 |
| 410 | 14.20 | 2.50 |
| 475 | 16 | 3.00 |

NOTE: When this machine leaves the factory the pump is set at 1.

If after calibration, the flow rate you want results in a pump setting below 1, reduce engine RPM to approximately 2000 to achieve optimum droplet size.

CAUTION:

Hand tighten nylon fittings. DO NOT use wrenches.

## 4. FLUSHING

A. With most chemicals, it is desirable to flush the fluid system and nozzle after each operation. To flush the system simply move the selector switch to the FLUSH position and turn the SPRAY switch to the ON position.

B. With most flushing fluids, a distinct change in the looks of the spray will occur once the flushing fluid has traveled through the whole system and is coming out the nozzle. If the spray is not visible, flush for an adequate period of time to get the flushing fluid completely through the system.

# VIII. SERVICE SCHEDULE

| Items to be serviced | HOURS | | | | |
|---|---|---|---|---|---|
| | Daily | 25 | 50 | 100 | 500 |
| Check Air Pressure | X | | | | |
| Clean Air Pump Air Filter | | | X | | |
| Check Air Pump Oil Level | | X | | | |
| Change Air Pump Oil | | | | | X |
| Change Air pump Breather | | | | | |
| Grease Air Pump Bearings | | | | X | |
| Check Battery | | | | X | |
| Check Engine Oil (Level) | X | | | | |
| Check Engine Oil (SAE-30) | | | | X* | |
| Change Engine Oil (Mutli-Viscosity) | | X | | | |
| Change Oil Filter | | | | X* | |
| Check Engine Air Intake (Finger Guard) | X | | | | |
| Clean Engine Cooling Fins | | | X | | |
| Clean Engine Air Foam Precleaner | | X | | | |
| Clean Engine Air Filter | | | | X | |
| Clean Engine Fuel Filter | | | | | X |
| Replace Engine Spark Plug | | | | X | |
| Engine, Decarbonize | | | | | X* |
| Engine Timing | | | | | X* |
| Engine Valve Clearance | | | | | X* |
| Engine Governor | | | | | X |
| Calibration | A/R | | | | |
| Check All Fittings | X | | | | |
| Clean Formulation Filter | | | | X | |
| Fill Flush Tank | X | | | | |
| Check Pulsation Damper | | | X | | |
| Check Belt Tension | | | X | | |

* Refer to engine service manual or authorized service dealer

## IX. MAINTENANCE

### 1. AIR PRESSURE

The nozzle air pressure can be checked at the gauge located on the flow control pump box. Pressure should be approximately 6 psi (.008 kgm2).

Air pressure is controlled mainly by engine speed which should be 2700-3000 RPM.

A. Engine speed not correct - see Engine Trouble Shooting, section X and Governor Maintenance, Section IV.

B. Engine speed correct - see Air Pump Trouble Shooting, section X.

### 2. AIR PUMP AIR FILTER

The air pump air filter should be checked and cleaned every 50 hours.

A. Loosen and remove the wing nut, rubber washer and filter outer housing.

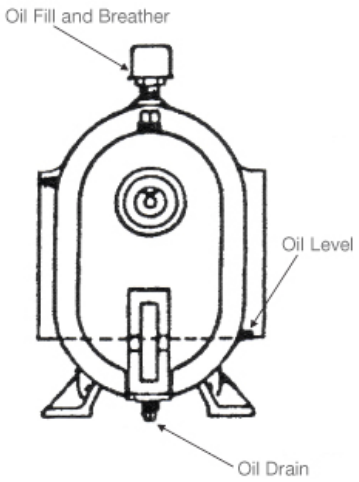
B. Clean the inner filter with a solvent, compressed air or other means as necessary.

C. Replace the filter, cover, rubber washer and wing nut.

### 3. AIR PUMP OIL LEVEL

A. Under normal conditions, the gearbox oil level should be checked every week or 25 hours, whichever comes first and changed every 120 days or 500 hours, whichever comes first. Use SAE 40 non-detergent oil.

B. To fill the gear box or add oil, remove the breather/plug and the oil level plug fill. Add oil through the breather plug hole until oil just starts to flow out of the oil level plug hole. Do not overfill. Replace the breather and oil level plug into their respective holes.




Proper lubrication is the most important single consideration in obtaining maximum air pump life. Check gear box oil level and grease shaft bearing per the maintenance.

### 4. AIR PUMP BEARINGS

A. Upper and lower shaft bearings at the drive end of the air pump are grease lubricated and each bearing housing is equipped with a pressure type (zerk) grease fitting. On the bearing housing - opposite side of the zerk fitting, is a pressure relief fitting that looks like a pipe plug with a hole drilled through it. It is normal for excess grease to flow out.

B. When servicing drive end bearings, use a premium grade, petroleum base grease with high temperature and moisture resistance and good mechanical stability. Using a pressure gun, force new lubricant into each drive end bearing housing until traces of grease comes out of the relief fitting.

C. After a long shutdown, it is recommended that the grease relief fittings be removed, the old grease flushed out with kerosene or #10 lubricating oil, drained thoroughly, and bearings refilled with new grease. Be sure grease relief fittings are reinstalled.

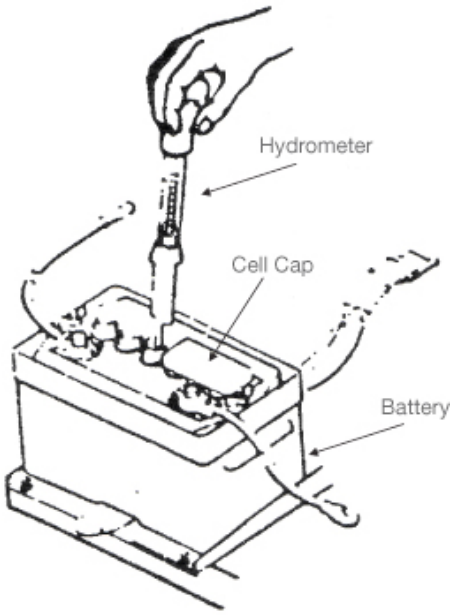
6. **AIR PUMP INTERNAL**

In salt air or other corrosive type atmospheres, extended periods of non-use (i.e. off-season storage) the internal parts of the air pump may be protected by removing the air pump inlet filter and while holding the engine throttle at idle, spray a fine mist of lubricating oil (approximately 2 oz. or 59 cc) into the air intake. This will coat and protect the internal parts of the air pump.

7. **BATTERY**

A. Each week or 100 hours, remove the battery vent caps and check the electrolyte level. Add clean distilled water, if necessary, to cover the battery plates. Replace the caps.

B. Check the specific gravity. If the specific gravity is between 1.250 and 1.280, the battery cell being tested is OK. If the specific gravity is between 1.225 and 1.250, the battery cell being tested is still in fair condition. If the specific gravity is below 1.150 in any one cell, replace the battery. If the specific gravity in one cell is 0.050 more or less than the other cells and charging does not bring the charge to a 50% charge, replace the battery.




8. **ENGINE OIL LEVEL**

BEFORE EACH USE check the oil as follows:

A. Make sure the engine is stopped and resting on a level surface. Also make sure the engine is cool and the oil has had time to drain into the sump.

B. Clean the area around the dipstick and filler cap to keep dirt and debris out of the engine.

C. Remove the dipstick and wipe oil off. Reinsert the dipstick and push it all the way down into tube. Remove the dipstick and check the level.

D. Add the proper type of oil if the level is low. Bring the level up to, but not over, the "F" mark on the dipstick before adding more oil.

CAUTION:

DO NOT operate the engine with the oil level below "L" mark or over "F" mark.

9. **ENGINE OIL CHANGE**

A. For a new engine, change oil after the first 5 hours of operation, thereafter, change oil after every 100 hours of operation.

B. Make sure the engine is stopped and the oil has had time to drain into the sump. Drain oil while engine is warm.

C. Remove the oil drain plug and oil fill cap. Tilt the engine slightly towards the oil drain to obtain better drainage.

D. Reinstall the drain plug. Make sure it is tightened securely.

E. Fill with high quality, detergent SAE 10W-30, service class "SF" oil to the "F" mark on the dipstick. Always check the level on the dipstick before adding more oil.

Reinstall the oil fill cap. Make sure it is tightened securely.

Make sure the engine is level when filling and checking oil.

F. If changing the oil filter, add oil to the "F" mark on the dipstick and then add 1/2 pint (76 cc) extra oil for the oil filter capacity.

G. Start the engine and check for oil leaks.

10. **ENGINE OIL FILTER**

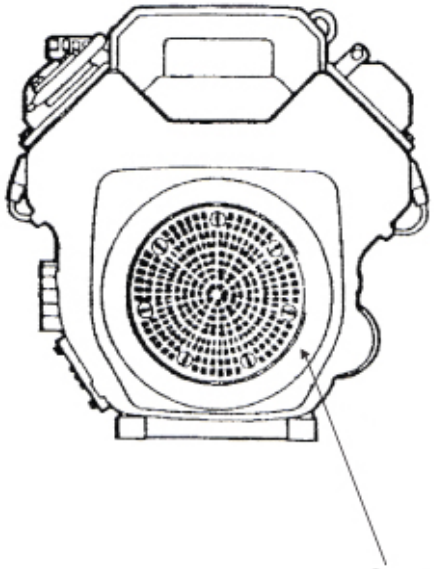
A. Change the engine oil filter at "each" or "every other" oil change depending on operating conditions A genuine Kohler oil filter is recommended.

(i) Drain crankcase oil, then remove old filter.
(ii) Before installing replacement filter apply a thin coating of oil on the surface of the rubber seal.
(iii) Turn filter clockwise until rubber seal contacts the filter adapter, then tighten filter and additional 1/2 turn.

B. Refill engine with oil - see section IX - 9 , above. Add an additional 1/2 pint (76 cc) of oil for the filter capacity.

11. **ENGINE AIR INTAKE SCREEN**

Make sure the air intake screen is clean and unobstructed. If debris builds up on screen during engine operation, STOP engine immediately and clean off. An obstructed screen can cause engine overheating.




12. **ENGINE COOLING FINS**

Every 50 operating hours (more often under extremely dusty or dirty conditions) remove cooling fins. Also clean dust, dirt, and oil from external surfaces of engine which can cause improper cooling. Make sure cooling shrouds are reinstalled. Operating the engine without cooling shrouds will cause engine damage due to overheating.

13. **ENGINE AIR FOAM PRECLEANER**

This engine is equipped with a high density paper air cleaner and an oiled foam precleaner which surrounds the paper element. Wash and re-oil the foam precleaner at least once every 25 hours.

A. Remove wing nut, air cleaner cover, element cover seals, and element cover.

B. Remove precleaner from paper element. Wash the precleaner in warm water with detergent.

C. Rinse the precleaner thoroughly until all traces of detergent are eliminated. Squeeze out excess water (do not wring). Air dry.

D. Saturate precleaner in clean, fresh engine oil and squeeze out excess oil.

E. Reinstall precleaner over paper element.

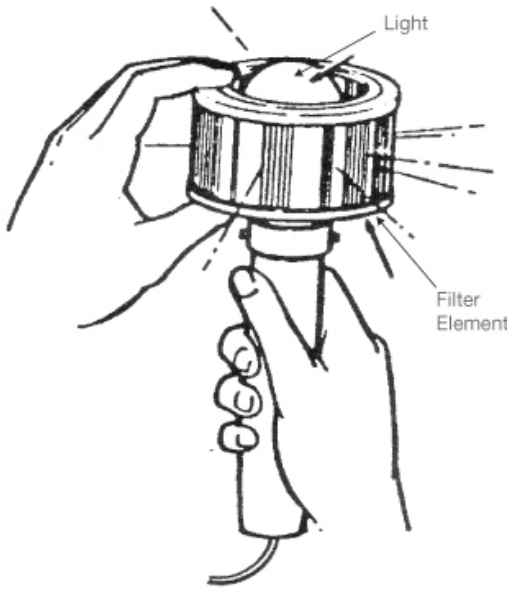
14. **ENGINE PAPER AIR FILTER**

Every 100 operating hours (more often under extremely dusty or dirty conditions) check the paper element. Clean or replace the element as necessary.

A. Remove the precleaner (if so equipped) from paper element.

B. Gently tap the flat side of paper element to dislodge dirt. do not wash the paper element or use pressurized air as this will damage the element. Replace a dirty, bent, or damaged element with a new element. Handle new elements carefully. do not use if sealing surfaces are bent or damaged.

C. With air cleaner disassembled, check the base. Make sure it is secured and not bent or damaged. Also check the element cover, seals, and breather tube for damage or improper fit. Replace all damaged components.




CAUTION:

Damaged or loose components could allow unfiltered air into the engine causing premature wear and failure.

D. Reinstall the paper element, precleaner, element cover, element cover seals, air cleaner cover, and wing nut. Tighten wing nut 1/2 to 1 full turn after the nut contacts cover. Do not over tighten.

15. **ENGINE FUEL FILTER**

This filter is located on the gas line between the engine and the gas tank. Clean as needed.

16. **ENGINE SPARK PLUGS**

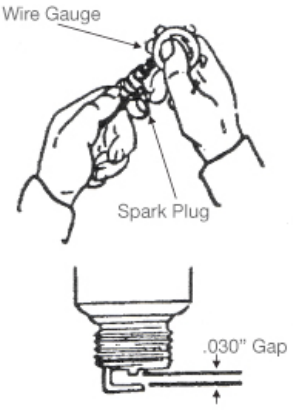
Every 200 operating hours remove the spark plugs, check condition and reset gaps, or replace with new plugs as follows:

A. Before removing spark plugs, clean the area around base of plugs to keep dirt and debris out of engine.

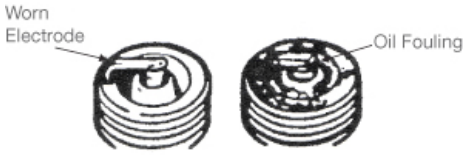
B. Remove plugs and check condition. Incorrect spark plugs, worn or fouled plugs, cracked porcelain, or improper spark gaps can cause hard starting or engine misfire.

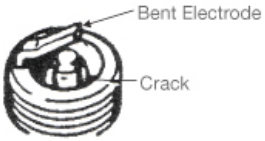
C. Do not clean the spark plugs in a machine using abrasive grit. Replace plugs when dirty or if reuse is questionable. See SPECIFICATIONS for plug type.

D. Check gaps (0.030") using a wire feeler gauge. adjust the gaps as necessary by carefully bending the ground electrode. Install the plugs and torque to 18-22 ft. lb.




Replace if the following conditions exists:






17. **DECARBONIZING ENGINE**

See your local Kohler Dealer.

18. **CHECK/SET ENGINE TIMING**

Refer to Engine Service Manual or Authorized Service Dealer.

19. **CHECK VALVE TAPPET CLEARANCES**

Refer to Engine Service Manual or Authorized Service Dealer.

## 20. CHECK/SET GOVERNOR

Check the engine operating speed with a hand held tachometer. A reflective type tachometer with the reflective tape on the flywheel screen or drive coupling is most desirable.

A. Engine speed should be 2600-3000 RPM.

B. To adjust the engine speed, find the governor adjusting rod between the muffler and left cylinder of the engine. Turn the hex nut in or out as necessary to bring the engine to the correct speed.

C. Some models may have a locking nut on the governor adjusting rod. Loosen and retighten as necessary

## 21. PULSATION DAMPER

The piston type metering pump tends to deliver a slightly pulsating flow of insecticide. For best aerosol particle size, a more even (non-pulsating) flow is desirable. A small air chamber type pulsation damper is located in the metering pump box assembly, between the pump and the aerosol discharge nozzle. It is a white nylon assembly with an air dome that can be unscrewed by hand for inspection. It has a gasket which seals the joint between the air dome and the lower section.

The air dome should be checked periodically to make sure that it has not become filled with insecticide. If the dome has no air in it, it will not function as a pulsation damper. Be careful to position the gasket ring carefully, so as to avoid pinching, when replacing the air dome.

## 22. FORMULATION FILTER

There is a fine mesh filter screen located in the large, cylindrical nylon housing. This screen can be removed for inspection and/or cleaning by manually unscrewing the cap. When reassembling, be sure that the sealing gasket is properly positioned so as to avoid damage caused by pinching. Tighten housing only hand tight during replacement; do not use tools.

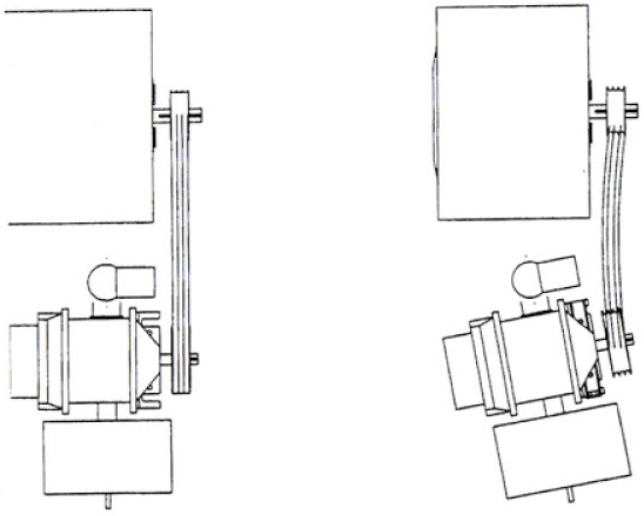
If the screen should become clogged, maximum formulation flow rate will not be attained.

## 23. DRIVE BELT ALIGNMENT

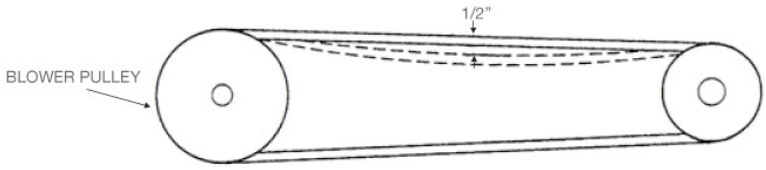
Check drive belts regularly. They should be in alignment and neither excessively tight nor loose enough to slip.
Both the engine and blower pulley bushings should be located 1/2” from the vertical belt guard mount.

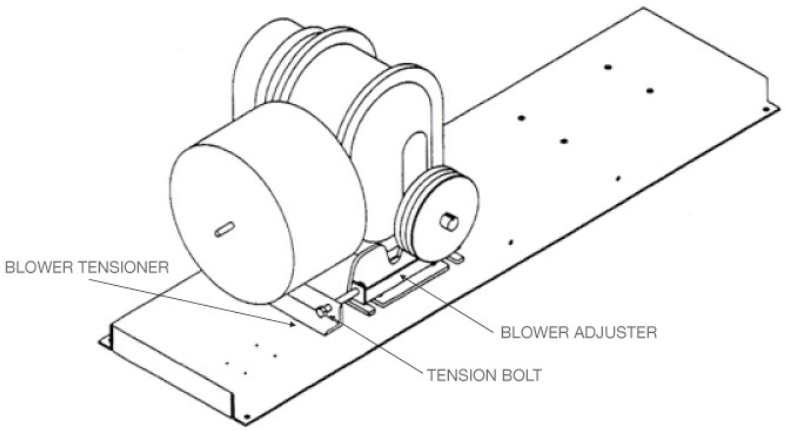
Since both pulleys are of the same thickness, a 2’ carpenter’s square can be used as an alignment tool.

Two belt tensioning bolts, one to push and one to pull, are located at the bottom of the roots blower. When properly tensioned, the belt should have approximately 1/2” deflection at 20 lbs. of force.



CORRECT INCORRECT



# X. TROUBLE SHOOTING

| Symptoms | Possible Cause | Corrective Action |
|---|---|---|
| 1. Starter fails to crank engine. | a. Battery cable connection loose dirty or damaged. | a. Clean & tighten cable connections. replace a damaged cable. |
| | b. Dead Battery. | b. Replace or charge battery. |
| | c. Starter solenoid defective or loose connection. | c. Replace solenoid & tighten connections. |
| | d. Defective starter switch. | d. Check starter button on engine and/or starter switch on remote control box. |
| | e. Starter defective. | e. Replace starter. |
| | f. Air pump locked up. | f. Inspect air pump for rotation. |
| | g. Fuse blown. | g. Replace Fuse. |
| 2. Engine hard to start or fails. | a. Start-Stop switch on engine in stop position or faulty. | a. Place switch in start position, replace faulty switch. |
| | b. Machine ON-Off switch located on remote control box in Off position or faulty. | b. Place switch in ON position replace faulty switch. |
| | c. No fuel or contaminated fuel. | c. Add fuel or clean tank and refuel. |
| | d. clogged fuel filter. | d. Clean or replace fuel filter. |
| | e. Spark plugs faulty. | e. Clean or replace plugs. |
| | f. Fuel pump or carburetor defective. | f. Consult nearest engine service center. |
| | g. Terminals loose or wiring defective. | g. Tighten loose terminals, replace defective wiring. |
| | h. Spark plug wire disconnected. | h. Connect spark plug wire. |
| 3. Engine misses or runs erratically. | a. Spark plugs faulty. | a. Clean or replace. |
| | b. Spark plug wire disconnected. | b. Connect spark plug wire. |
| | c. Contaminated fuel. | c. Replace fuel. |
| | d. Clogged fuel filter. | d. Clean or replace. |
| | e. Carburetor mounting gasket leaks. | e. Tighten bolts, replace gasket if necessary. |
| | f. Cylinder head gasket leaks. | f. Tighten cylinder head bolts. |
| 4. Engine knocks or develops noise. | a. Crankcase oil low. | a. Fill oil to proper level, after oil fill if noise continues, consult nearest engine service center. |
| | b. Mufflers clogged. | b. Clean or replace. |
| | c. Flywheel loose. | c. Consult nearest engine service center. |
| 5. Engine will not run smoothly. | a. Carburetor dirty or out of adjustment. | a. Clean or adjust carburetor. |
| 6. Engine overheats. | a. Crankcase oil low. | a. Add oil to proper level. |
| | b. Air shroud clogged. | b. Clean or replace air shroud. |
| | c. Exhaust restricted. | c. Replace muffler. |
| 7. Engine backfires. | a. Gasoline mixture too lean. | a. Adjust carburetor. |
| | b. Defective spark plugs. | b. Clean, adjust and/or replace. |
| | c. Inlet valves sticking. | c. Free, clean and adjust valve. |
| 8. Engine compression low. | a. Valve clearance improper. | a. Adjust valve. |
| | b. Defective cylinder head. | b. Consult nearest engine service center. |
| | c. Defective valves or piston rings. | c. Consult nearest engine service center. |
| | d. Cylinder head gaskets leaks. | d. Tighten head bolts or replace gasket. |
| 9. Engine doesn't deliver full power. | a. Carburetor choke valve partly closed. | a. Adjust choke. |
| | b. Air cleaner dirty. | b. Service air cleaner. |
| | c. Carburetor defective. | c. Clean, adjust or replace. |
| | d. Exhaust restricted. | d. Replace muffler. |
| 10. Engine stops suddenly. | a. Ignition switch faulty. | a. Replace ignition switch. |
| | b. Fuel system has dirt, water or gum. | b. Clean fuel tank, line & check fuel filter. |
| | c. Defective choke. | c. Inspect choke. |
| | d. Carburetor defective. | d. Clean or replace. |
| | e. Air pump locked up. | e. Inspect air pump for rotation. |
| | f. Fuel pump defective. | f. Clean or replace. |
| | g. Faulty wiring. | g. Tighten loose terminal, replace defective wiring. |
| | h. Remote control unplugged. | h. Connect remote control. |
| | i. Low oil level. | i. Fill oil to full mark. |
| | j. Fuse blown. | j. Replace Fuse. |

## X. TROUBLE SHOOTING (continued)

| Symptoms | Possible Cause | Corrective Action |
|---|---|---|
| 11. Output light not lit when output switch in ON position. | a. Machine not turned on. | a. Turn on ignition switch. |
| | b. Defective switch. | b. Replace switch. Switch may be temporarily shorted across terminals for test. |
| | c. Lamp defective. | c. Replace bulb. |
| 12. Formulation pump runs but no output. | a. Leak in suction line. | a. Check lines, tighten. |
| | b. Out of formulation. | b. Check that both formulation tank and flush tank have solution in them. |
| | c. Output solenoid not opening. | c. Check voltage at connector which goes to solenoid. Should be 12 volts. If not, check voltage at control panel. |
| | d. Filter gasket pinched. | d. Replace gasket. |
| | e. Filter plugged. | e. Clean or replace. |
| | f. Pumped defective. | f. Visually check pump for rotation and piston movement. |
| 13. Formulation pump runs all the time. | a. Override switch in ON position. | a. Turn override switch to OFF position. |
| **Air Pump** | | |
| 14. Air pump will not operate while engine is running. | a. Shaft belt broken. | a. Replace belt. |
| | b. Gears in blower damaged. | b. Consult factory. |
| 15. Air pump makes excessive noise. | | a. Consult factory. |
| 16. No air flow. | a. Speed too low. | a. Check engine RPM by tachometer. |
| | b. Obstruction in piping. | b. Check piping, screen, valves, silencer, to assure an open flow path. |
| 17. Low capacity. | a. Speed too low. | a. Check engine RPM. |
| | b. Excessive pressure. | b. Outlet obstructed see item 16b. |
| | c. Obstruction in piping. | c. See item 16b. |
| | d. Excessive slip. | d. Check inside of casing for worn or eroded surfaces causing excessive clearances. Consult factory. |
| 18. Excessive power required. | a. Speed too high. | a. Check RPM. |
| | b. Pressure too high. | b. See item 17b. |
| | c. Impellers rubbing. | c. Inspect outside of cylinder and headplates for high temperature areas, then check for impeller contacts at these points. Correct blower counting, drive alignment. |
| 19. Overheating of bearing or gears. | a. Inadequate lubrication. | a. Restore correct oil levels in gearbox and lubricate. |
| | b. Excessive lubrication | b. Check gear oil level. if correct, drain and refill with clean oil of recommended grade. |
| | c. Excessive pressure rise. | c. See item 17b. |
| | d. Belt misalignment. | d. Check carefully. Realign if questionable. |
| | e. Speed too low. | e. Speeds lower than the minimum recommended will overheat the entire blower. |
| 20. Vibration | a. Belt misalignment. | a. See item 19d. |
| | b. Impellers rubbing. | b. See item 18c. |
| | c. Worn bearings/gears. | c. Check gear backlash and condition of bearings. |
| | d. Unbalanced or rubbing impellers. | d. Scale or process material may build up on casing and impellers, or inside impellers. Remove build-up to restore original clearances and impeller balance. |
| | e. Driver or blower loose. | e. Tighten mounting bolts securely. |
| | f. Piping resonances. | f. Determine whether standing wave pressure pulsations are present in the piping. Consult factory. |

# IX. PREPARATION FOR STORAGE

## 1. GENERAL

If the unit is to be out of service for two or more months clean the entire machine with soapy water. Rinse and dry thoroughly.

## 2. BLOWER

When a blower is taken out service it may require internal protection against rusting or corrosion. The need for such protection must be a matter of judgment based on existing conditions as well as length of downtime. Under favorable conditions, protection will probably not be needed if shut-down is not longer than a month.

Under atmospheric conditions producing rapid corrosion or for storage periods longer than one month:

A. Remove the cover and screen on the air intake silencer. Start the engine and pour one pint of lubricating oil (SAE 40) in the blower intake. shut the engine down immediately. Replace the cover and screen. The oil will coat the entire inner surface of the blower. This will prevent a coat of rust from forming in the blower.

B. Service drive end bearings, use a NLGI #2 premium grade, petroleum base grease with high temperature (300 degrees service temperature) and moisture resistance and good mechanical stability. Using a pressure gun, force new lubricant into each drive end bearing housing until traces of clean grease comes out of the relief fitting.

After a long shutdown, it is recommended that the grease relief fittings be removed, the old grease flushed out with kerosene or #10 lubricating oil, drained thoroughly, and bearings refilled with new grease. Be sure grease relief fittings are reinstalled.

C. Change gearbox oil per maintenance chart.

## 3. ENGINE

A. Add a fuel stabilizer to the fuel tank and run engine for 15 minutes.

B. Drain oil from crankcase while engine is still warm from operation. Refill engine to "F" mark on dipstick with proper viscosity oil.

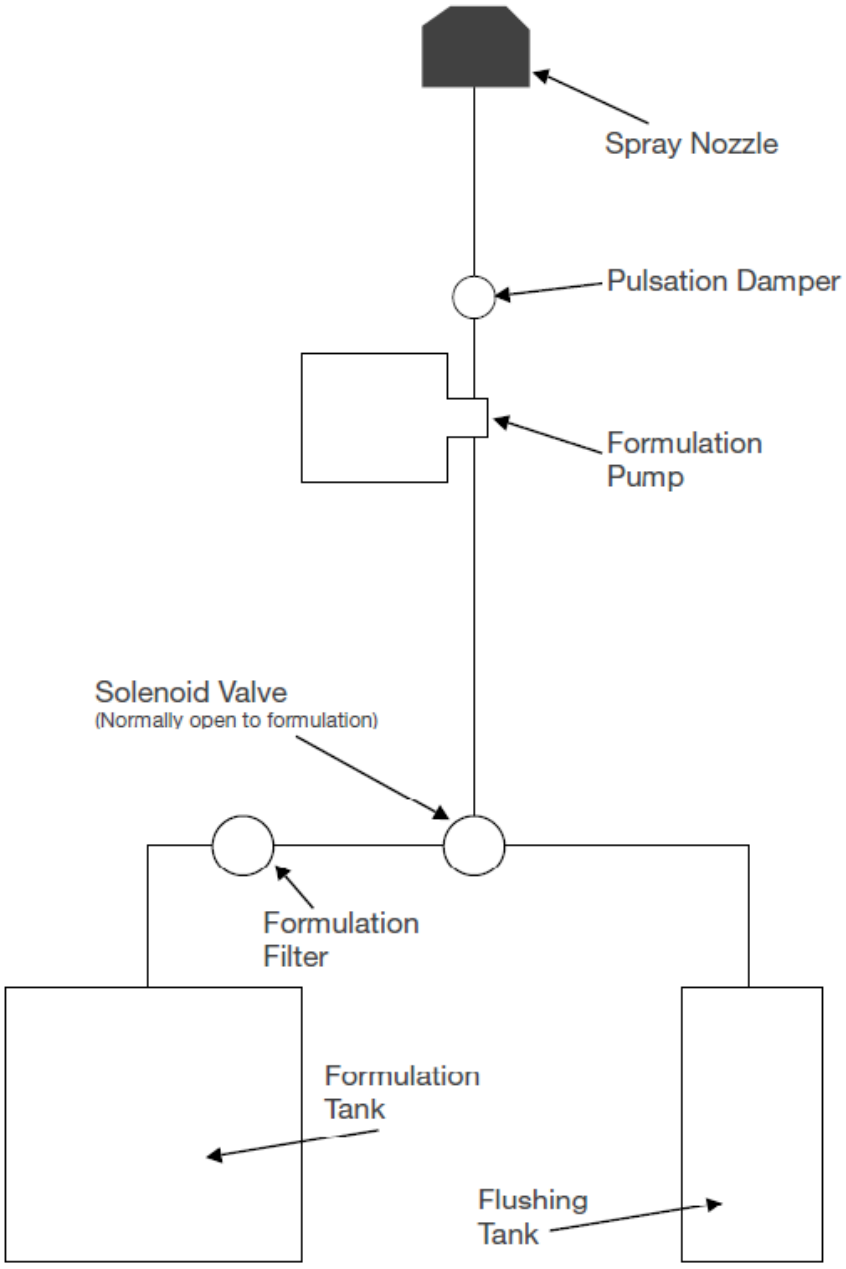
C. Remove spark plug and add a tablespoon of engine oil into the spark plug hole. Install plug, but do not connect plug lead. Crank engine slowly 2 to 3 revolutions.

D. Spread a light film of oil over any exposed metal surfaces of engine to prevent rust.

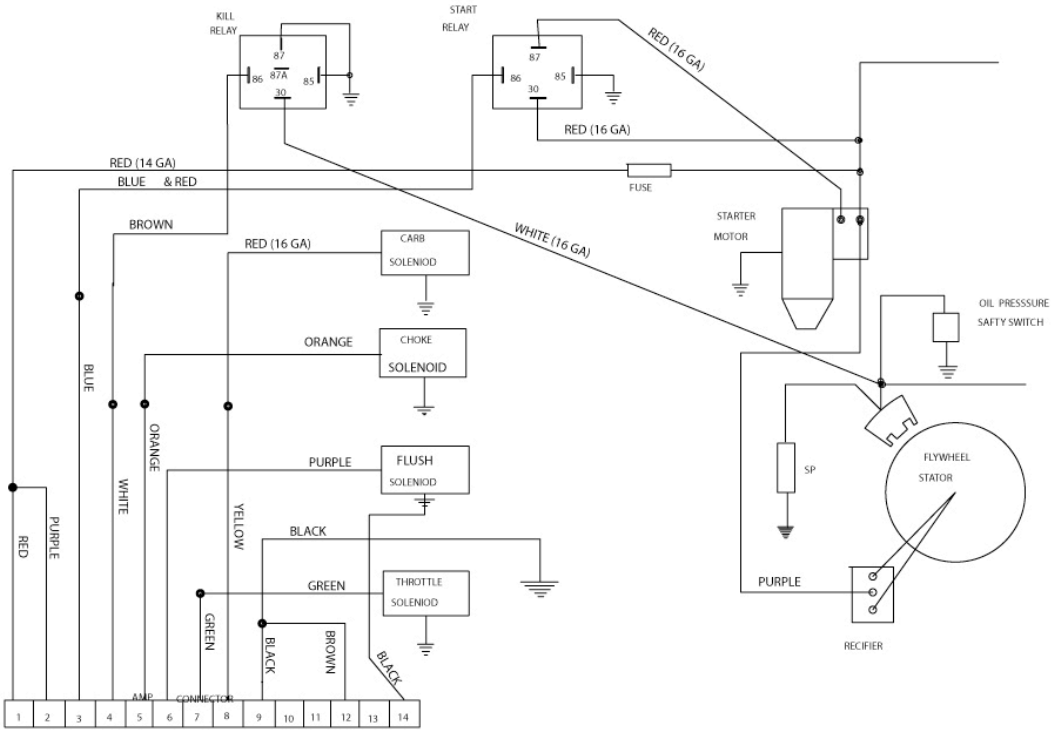
## 4. STORAGE

Store the unit in a clean, dry place.

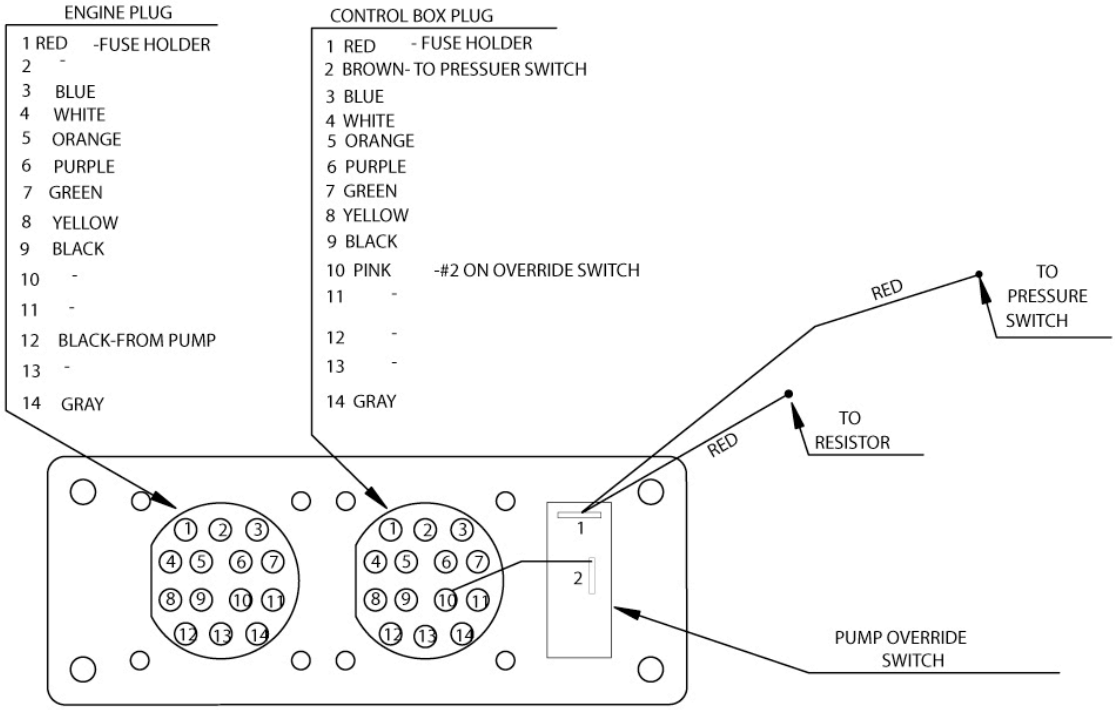
# FLUID SYSTEMS DIAGRAM



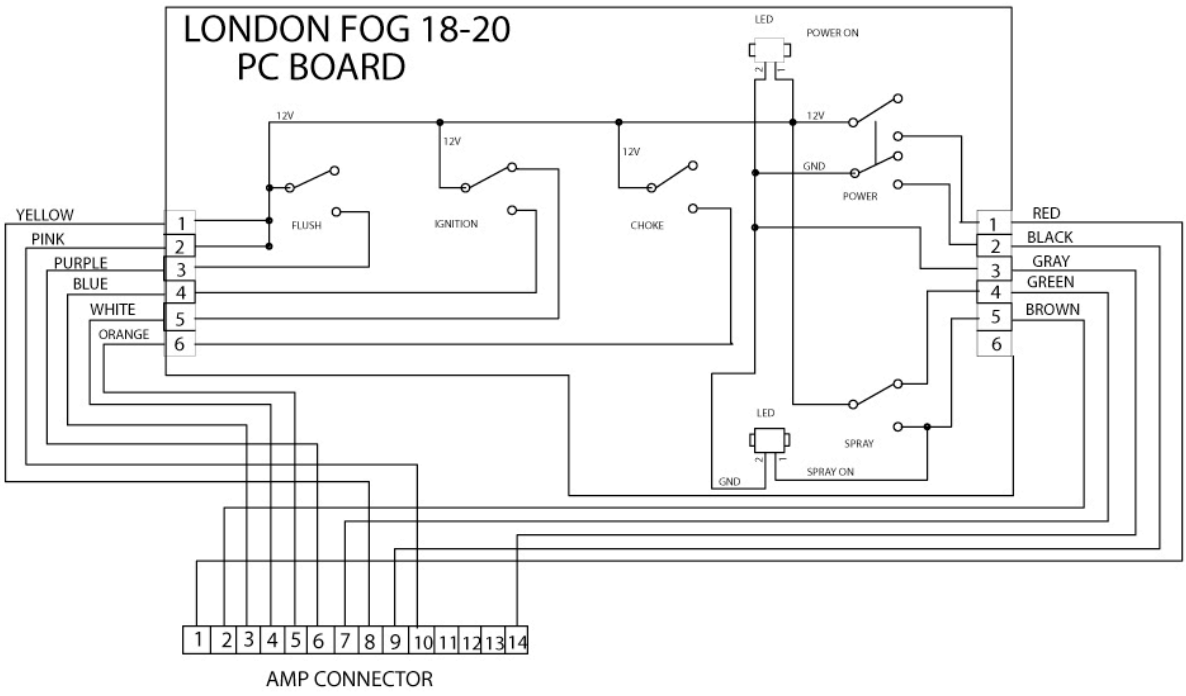
# 18-20 ENGINE
# WIRE DIAGRAM



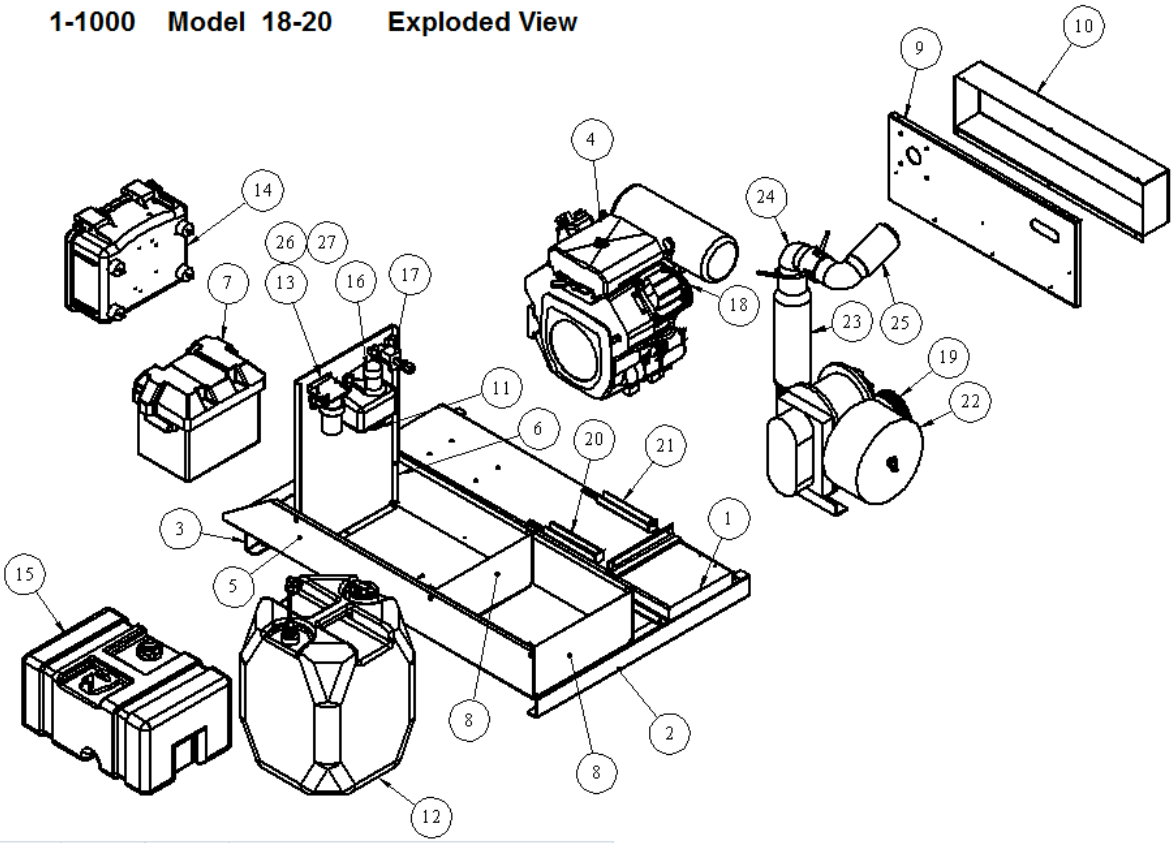
# Pump Box
# Wiring Diagram



# 18-20 YELLOW CAB CONTROL
# WITH P.C. BOARD

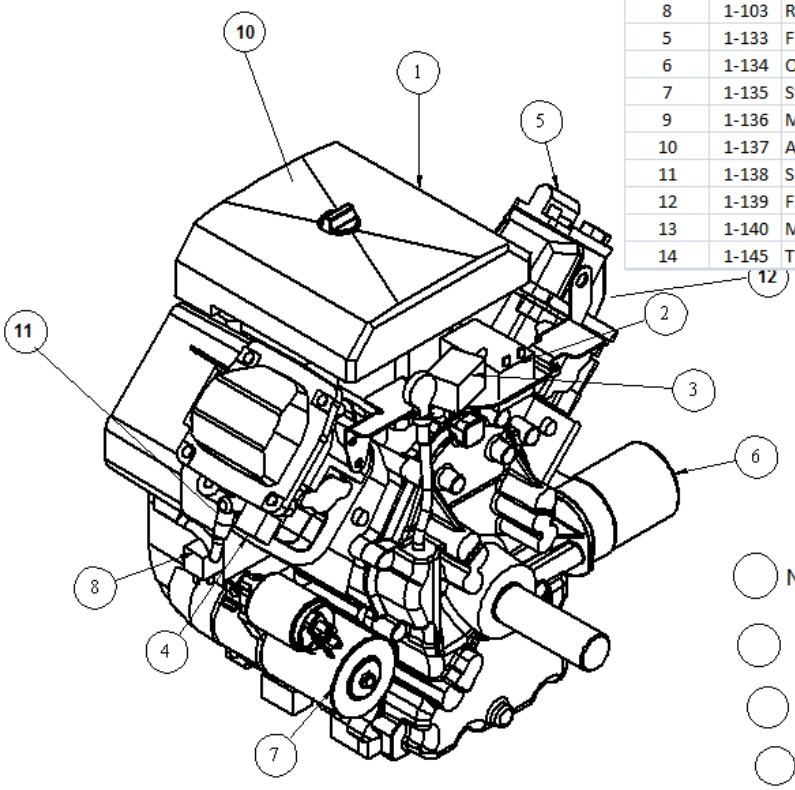


## 1-1000 Model 18-20 Exploded View




| Item # | Part # | Qty. | Discription |
|---|---|---|---|
| 1 | 1-408 | 1 | Hat Frame 18-20 |
| 2 | 1-406 | 1 | Rail 18-20 Left |
| 3 | 1-407 | 1 | Rail 18-20 Right |
| 4 | 1-100 | 1 | Engine Assy 18HP Kohler Command |
| 5 | 1-411 | 1 | Tank Tray |
| 6 | 1-413 | 1 | Large Divider Tank Tray |
| 7 | 1-775 | 1 | Box Battery |
| 8 | 1-412 | 2 | Small Divider Tank Tray |
| 9 | 1-410 | 1 | Belt Guard Mount Bracket |
| 10 | 1-409 | 1 | Belt Guard |
| 11 | 1-675 | 1 | Pressure Gauge Complete Assy |
| 12 | 1-700 | 1 | 15 Gallon Formulation Tank Black |
| 13 | 1-650 | 1 | Filter Assembly Complete with fittings |
| 14 | 1-500 | 1 | Pump Box Black Assy Complete w pump |
| 15 | 1-750 | 1 | Gas Tank 18HP 6.0 Gallons |
| 16 | 1-725 | 1 | Flush Tank w/ cap |
| 17 | 1-600 | 1 | Spray Flush Solenoid with fittings |
| 18 | 1-123 | 1 | Engine Pulley (w/o bushing) |
| 19 | 1-205 | 1 | Blower Pulley (w/o bushing) |
| 20 | 1-209 | 1 | Belt Tensioner Foot with Nut |
| 21 | 1-210 | 1 | Belt Tensioner Foot w/o Nut |
| 22 | 1-200 | 1 | Blower Complete with Pulley and Nozzle |
| 23 | 1-220 | 1 | Silencer Tube Assembly Complete |
| 24 | 1-227 | 1 | Swivel Elbow Nozzle to Silenc. Assy |
| 25 | 1-300 | 1 | Hoot Nozzle Assy Complete |
| 26 | 1-652 | 1 | Filter Assembly Gasket Green |
| 27 | 1-657 | 1 | Screen Filter replacement, Formulation Filter |

# 1-100 Engine Assembly 18-20
# Exploded View




| Item # | Part # | Description | Qty. |
|---|---|---|---|
| 1 | 1-100 | Engine Assembly Complete Wired | 1 |
| 2 | 1-131 | Idle Solenoid | 1 |
| 3 | 1-132 | Choke Solenoid Command | 1 |
| 4 | 1-102 | Relay Kill 5 Pin | 1 |
| 8 | 1-103 | Relay 4 pin Start Relay | 1 |
| 5 | 1-133 | Fuel Pump assembly | 1 |
| 6 | 1-134 | Oil Filter | 1 |
| 7 | 1-135 | Starter 18HP Command | 1 |
| 9 | 1-136 | Muffler Kit Complete w Gaskets | 1 |
| 10 | 1-137 | Air Filter /Pre Filter | 1 |
| 11 | 1-138 | Spark Plugs | 2 |
| 12 | 1-139 | Fuel Filter | 1 |
| 13 | 1-140 | Muffler Guard Protector | 1 |
| 14 | 1-145 | Tiny Tachometer / Engine Hr Mtr | 1 |

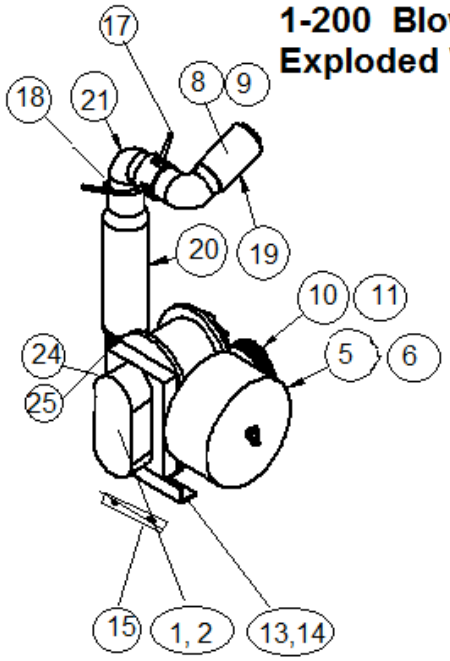
Not shown, 9,10,11,12,13,14

Engine Wire Harness PN# 1-105 w/ Amp Plug

Engine Pulley PN#1-130
Engine Bushing PN# 1-131

** Engine Oil Please use 1.5 Quarts 10W-30 **

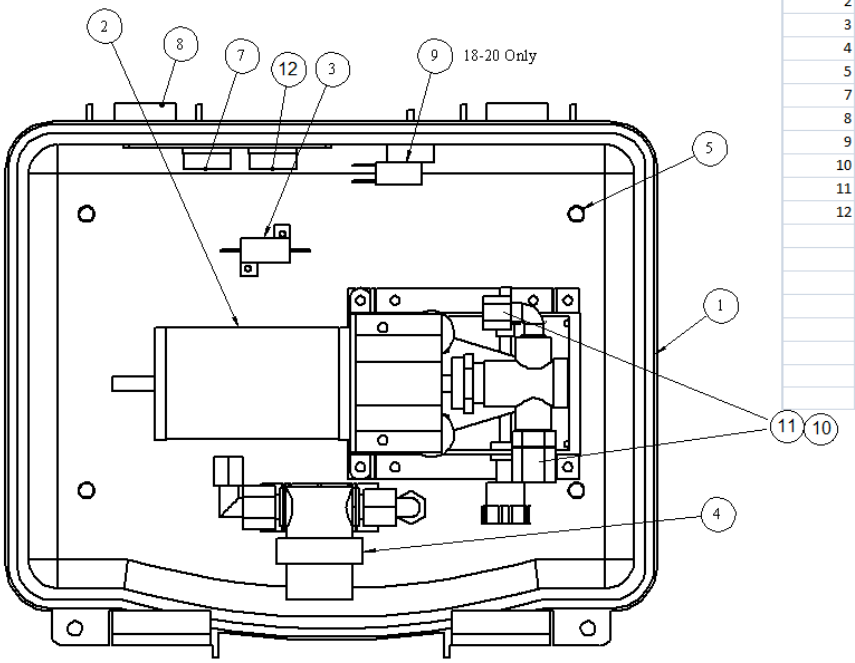
# 1-200 Blower Assembly Exploded View




| Item # | Part # | Qty. | Description |
|---|---|---|---|
| 1 | 1-200 | 1 | Blower Assy Comp. w Nozzle |
| 2 | 1-201 | 1 | Blower Only |
| 3 | 1-207 | 1 | Mobil DTE OIL 13 Oz. |
| 4 | 1-312 | 1 | Snapring Nozzle Retainer |
| 5 | 1-203 | 1 | Air Filter Complete Assy |
| 6 | 1-204 | 1 | Air Filter Element Only |
| 7 | 1-315 | 2 | O-Ring, Nozzle, Muffler |
| 8 | 1-313 | 1 | Brass Nipple Nozzle to Fluid Line |
| 9 | 1-314 | 1 | 90 deg. Jaco Fitting Nozzle |
| 10 | 1-205 | 1 | Blower Pulley (wo bushing) |
| 11 | 1-206 | 1 | Blower Pulley Bushing |
| 12 | 1-202 | 1 | Triple V Belt 18HP |
| 13 | 1-209 | 1 | Belt Tensioner Foot with Nut |
| 14 | 1-210 | 1 | Belt Tensioner Foot w/o Nut |
| 15 | 1-211 | 2 | Nut Plate Fastener, Blower Spec |
| | | | |
| 16 | 1-224 | 2 | Socket Hex Safety Set Screw |
| 17 | 1-225 | 2 | Locking Handle 45 deg bend |
| 18 | 1-226 | 1 | Fluid Line Holder Stand Off |
| 19 | 1-300 | 1 | Nozzle Assembly Complete |
| 20 | 1-220 | 1 | Silencer Tube Assembly |
| 21 | 1-227 | 1 | Swivel Elbow Nozzle to Silenc. Assy |
| 22 | 1-208 | 1 | Silencer Tube Blower Bracket |
| 23 | 1-212 | 1 | *U-Bolt* Silencer Tube |
| 24 | 1-214 | 1 | Street Elbow for Sil. tube to Blower |
| 25 | 1-230 | 1 | Blower Pressure Hose Complete |
| | | | |
| 27 | 1-1006 | | Blower to Hoot Nozzle Complete |
| | | --- | Includes all qty parts from Blower |
| | | | elbow to Nozzle and hose |

◯ ** Blower Gear Oil use Ball Bearing or Circulating oil only, 12 ozs max

## 1-500 Pump Box Exploded View




| Item # | Part # | Description | Qty. |
|---|---|---|---|
| 1 | 1-501A | Pump Box Complete | 1 |
| 1 | 1-502 | Pump Box Only Black | 1 |
| 2 | 1-550 | Pump-F.M.I. 3/8 in Ceramic Piston | 1 |
| 3 | 1-503 | Resistor 18-20/XKE/9-10 (Incl Heat Sheild) | 1 |
| 4 | 1-504 | Pulse Dampener w/ Bracket and Hose Fittings | 1 |
| 5 | 1-505 | Rubber Vibration Mounting Foot | 4 |
| 7 | 1-510 | Panel, Electrical Assembly Complete | 1 |
| 8 | 1-511 | Toggle Switch | 1 |
| 9 | 1-512 | Pressure Switch | 1 |
| 10 | 1-513 | Pump Fitting, Jaco 1/4 x 3/8 male | 1 |
| 11 | 1-514 | Pump Fitting, Jaco 1/4 x 3/8 90 deg male | 1 |
| 12 | 1-515 | Amp Plug Square Receptacle | 2 |
| | 1-516 | Automotive style Fuse Holder Male/Female | 1 |
| | 1-517 | 5 AMP SloBlo Fuse | 1 |
| | 1-518 | 3/8 O.D. TUBING price by Foot | 1 |
| | 1-520 | Hobbs Meter (Optional) | 1 |
| | 1-521 | Pump Box Lid | 1 |
| | 1-522 | Decal "London Foggers" | 1 |
| | 1-551 | Pump Head FMI Pump | 1 |
| | 1-552 | Lip Seal Kit including 2 gland washers, 1 lip seal | 1 |